

Harmonic Test Report

IEC 61400-21:2008 Current harmonics, Interharmonics and Higherfrequency components

TYPE TEST SHEET

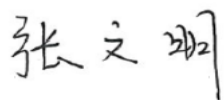
This Type Test sheet shall be used to record the results of the type testing of Generating Unit			
Type Tested reference number		SG320HX、SG333HX、SG350HX	
Generating Unit technology		Grid-connected PV Inverter	
System supplier name		Sungrow Power Supply Co., Ltd.	
Address		No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China	
Tel	+86 551 65327834	Fax	+86 551 6532 7800
E:mail	info@sungrow.cn	Web site	www.sungrowpower.com
Maximum export capacity, use separate sheet if more than one connection option.	N/A	kW single phase, single, split or three phase system	
	352	kW three phase	
	N/A	kW two phases in three phase system	
	N/A	kW two phases split phase system	
Compiled by		On behalf of	Sungrow Power Supply Co., Ltd.
Approved by		Test Date	2022-11-15
<p>Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.</p> <p>Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.</p>			

Table 1-Current distortion limits

Odd harmonics	Distortion limit
3 rd through 9 th	Less than 4.0%
11 rd through 15 th	Less than 2.0%
17 rd through 21 th	Less than 1.5%
23 rd through 33 th	Less than 0.6%
Even harmonics	Distortion limit
2 rd through 8 th	Less than 1.0%
10 rd through 32 th	Less than 0.5%

NOTE Testing harmonics is very problematic, since voltage distortion may feed to enhanced current distortion. The harmonic current injection should be exclusive of any harmonic currents due to harmonic voltage distortion present in the utility grid without the PV system connected. Type tested inverters meeting the above requirements should be deemed to comply without further testing.

Low levels of current and voltage harmonics are desirable; the higher harmonic levels increase the potential for adverse effects on connected equipment. Acceptable levels of harmonic voltage and current depend upon distribution system characteristics, type of service, connected loads/apparatus, and established utility practice. Total harmonic current distortion shall be less than 5% at rated inverter output. Each individual harmonic shall be limited to the percentages listed in Table 1. Even harmonics in these ranges shall be less than 25% of the lower odd harmonic limits listed. IEC61400-21:2008 Item6.4 Current harmonics, Interharmonics and Higherfrequency components regulation as below: The emission of current harmonics, interharmonics and higher frequency components during continuous operation shall be stated (see Note). The values of the individual current components (harmonics, interharmonics and higher frequency components) and the total harmonic current distortion shall be given in tables in percentage of I_n and for operation of the wind turbine within the active power bins 0, 10, 20, ... , 100 % of P_n . 0, 10, 20, ... , 100 % are the bin midpoints. The individual harmonic current components shall be specified as subgrouped values for frequencies up to 50 times the fundamental grid frequency, and the total harmonic current distortion shall be stated as derived from these. The Interharmonic current components shall be specified as subgrouped values for frequencies up to 2 kHz in accordance to Annex A of IEC 61000-4-7:2002. The higher frequency current components shall be specified as subgrouped values for frequencies between 2 kHz and 9 kHz in accordance to Annex B of IEC 61000-4-7:2002.

1、 Current Harmonics:

Pbin(%)	0	10	20	30	40	50	60	70	80	90	100	104	110	MAX (%)	Limit(%)
Nr.	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)		
2	0.024	0.017	0.016	0.040	0.047	0.091	0.092	0.061	0.086	0.079	0.098	0.152	0.090	0.152	1
3	0.085	0.078	0.053	0.052	0.052	0.085	0.059	0.064	0.085	0.105	0.141	0.142	0.194	0.194	4
4	0.022	0.013	0.039	0.064	0.055	0.042	0.031	0.033	0.046	0.060	0.075	0.106	0.047	0.106	1
5	0.041	0.058	0.064	0.057	0.056	0.054	0.060	0.054	0.064	0.059	0.058	0.269	0.071	0.269	4
6	0.017	0.022	0.019	0.019	0.019	0.022	0.022	0.022	0.028	0.045	0.059	0.078	0.048	0.078	1
7	0.032	0.037	0.053	0.036	0.026	0.036	0.059	0.074	0.092	0.110	0.126	0.215	0.109	0.215	4
8	0.014	0.020	0.020	0.031	0.022	0.022	0.017	0.017	0.023	0.026	0.031	0.082	0.058	0.082	1

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9	0.021	0.034	0.035	0.027	0.030	0.029	0.028	0.036	0.042	0.050	0.047	0.442	0.029	0.442	4
10	0.016	0.019	0.027	0.017	0.018	0.020	0.018	0.020	0.017	0.019	0.021	0.065	0.034	0.065	0.5
11	0.358	0.361	0.112	0.254	0.203	0.154	0.240	0.322	0.367	0.396	0.408	0.402	0.294	0.408	2
12	0.013	0.011	0.013	0.012	0.010	0.007	0.010	0.013	0.017	0.021	0.020	0.054	0.023	0.054	0.5
13	0.220	0.230	0.233	0.141	0.148	0.097	0.035	0.024	0.047	0.099	0.130	0.355	0.354	0.355	2
14	0.012	0.014	0.012	0.011	0.010	0.007	0.011	0.012	0.013	0.017	0.022	0.069	0.027	0.069	0.5
15	0.016	0.021	0.022	0.020	0.014	0.024	0.026	0.024	0.025	0.028	0.028	0.359	0.026	0.359	2
16	0.010	0.013	0.011	0.015	0.012	0.011	0.013	0.012	0.013	0.017	0.017	0.075	0.021	0.075	0.5
17	0.016	0.078	0.116	0.131	0.134	0.204	0.179	0.131	0.091	0.069	0.087	0.594	0.548	0.594	1.5
18	0.009	0.009	0.010	0.009	0.009	0.010	0.011	0.012	0.013	0.014	0.017	0.045	0.021	0.045	0.5
19	0.120	0.140	0.134	0.091	0.072	0.046	0.113	0.151	0.163	0.184	0.180	0.402	0.348	0.402	1.5
20	0.011	0.010	0.010	0.014	0.011	0.010	0.012	0.015	0.017	0.021	0.022	0.074	0.022	0.074	0.5
21	0.015	0.019	0.018	0.017	0.021	0.022	0.025	0.028	0.034	0.037	0.049	0.292	0.045	0.292	1.5
22	0.008	0.011	0.012	0.013	0.015	0.012	0.013	0.015	0.018	0.021	0.021	0.075	0.028	0.075	0.5
23	0.100	0.080	0.050	0.043	0.109	0.126	0.152	0.173	0.203	0.241	0.248	0.503	0.411	0.503	0.6
24	0.009	0.009	0.008	0.009	0.008	0.008	0.009	0.010	0.011	0.013	0.014	0.042	0.024	0.042	0.5
25	0.072	0.089	0.069	0.076	0.044	0.056	0.106	0.132	0.152	0.175	0.181	0.368	0.312	0.368	0.6
26	0.010	0.012	0.009	0.011	0.010	0.009	0.010	0.012	0.016	0.020	0.019	0.084	0.021	0.084	0.5
27	0.014	0.016	0.014	0.014	0.017	0.015	0.019	0.023	0.026	0.032	0.042	0.207	0.048	0.207	0.6
28	0.008	0.009	0.008	0.013	0.012	0.011	0.012	0.014	0.016	0.020	0.020	0.079	0.022	0.079	0.5
29	0.105	0.043	0.030	0.041	0.083	0.095	0.138	0.166	0.192	0.230	0.241	0.331	0.280	0.331	0.6
30	0.009	0.009	0.007	0.010	0.008	0.007	0.009	0.009	0.010	0.012	0.012	0.039	0.022	0.039	0.5
31	0.048	0.024	0.063	0.061	0.085	0.071	0.110	0.135	0.159	0.180	0.186	0.320	0.249	0.320	0.6
32	0.011	0.013	0.010	0.012	0.010	0.009	0.010	0.012	0.015	0.019	0.017	0.101	0.023	0.101	0.5
33	0.012	0.014	0.012	0.014	0.012	0.015	0.017	0.019	0.024	0.030	0.039	0.126	0.045	0.126	0.6
34	0.009	0.011	0.009	0.011	0.010	0.009	0.011	0.013	0.016	0.019	0.017	0.070	0.018	0.070	
35	0.083	0.058	0.025	0.034	0.063	0.077	0.114	0.141	0.166	0.199	0.207	0.205	0.189	0.205	
36	0.010	0.010	0.009	0.010	0.008	0.007	0.009	0.011	0.011	0.012	0.012	0.034	0.019	0.034	
37	0.029	0.039	0.064	0.081	0.094	0.079	0.110	0.132	0.152	0.178	0.185	0.245	0.169	0.245	
38	0.012	0.012	0.010	0.012	0.011	0.011	0.013	0.019	0.021	0.024	0.021	0.092	0.022	0.092	
39	0.010	0.011	0.012	0.013	0.011	0.014	0.015	0.014	0.019	0.025	0.032	0.063	0.032	0.063	
40	0.017	0.018	0.021	0.021	0.020	0.021	0.026	0.024	0.024	0.026	0.024	0.069	0.017	0.069	
41	0.052	0.012	0.015	0.024	0.052	0.061	0.094	0.117	0.139	0.165	0.171	0.113	0.159	0.113	
42	0.011	0.011	0.009	0.010	0.009	0.008	0.009	0.013	0.015	0.017	0.016	0.028	0.015	0.028	
43	0.027	0.023	0.032	0.064	0.088	0.074	0.101	0.121	0.142	0.164	0.172	0.163	0.094	0.163	
44	0.011	0.011	0.011	0.012	0.011	0.011	0.011	0.012	0.013	0.016	0.013	0.079	0.019	0.079	
45	0.010	0.011	0.012	0.012	0.012	0.012	0.012	0.011	0.014	0.019	0.023	0.032	0.022	0.032	
46	0.011	0.010	0.010	0.012	0.010	0.009	0.008	0.011	0.013	0.015	0.013	0.044	0.016	0.044	
47	0.040	0.021	0.030	0.032	0.047	0.046	0.072	0.094	0.111	0.137	0.139	0.084	0.144	0.084	
48	0.010	0.010	0.008	0.009	0.008	0.008	0.008	0.009	0.010	0.010	0.009	0.024	0.012	0.024	
49	0.040	0.041	0.037	0.048	0.048	0.071	0.108	0.117	0.126	0.145	0.147	0.086	0.033	0.086	
50	0.010	0.010	0.008	0.013	0.011	0.010	0.012	0.012	0.012	0.013	0.012	0.047	0.018	0.047	
THC (%)	0.500	0.501	0.369	0.397	0.399	0.407	0.507	0.592	0.676	0.773	0.814	1.417	1.096	1.417	

2、 Interharmonics at continuous operation:

Pbin(%)	0	10	20	30	40	50	60	70	80	90	100	104	110	Max (%)
f(Hz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)
75	0.053	0.049	0.059	0.074	0.097	0.125	0.144	0.158	0.177	0.194	0.215	0.109	0.122	0.215
125	0.026	0.027	0.030	0.036	0.041	0.051	0.056	0.066	0.072	0.087	0.097	0.094	0.101	0.101

175	0.022	0.023	0.027	0.030	0.035	0.039	0.042	0.051	0.054	0.065	0.070	0.081	0.078	0.081
225	0.043	0.044	0.057	0.058	0.062	0.068	0.079	0.085	0.091	0.099	0.108	0.071	0.077	0.108
275	0.049	0.044	0.054	0.058	0.070	0.081	0.091	0.097	0.099	0.102	0.110	0.070	0.047	0.110
325	0.040	0.036	0.030	0.032	0.035	0.043	0.047	0.055	0.061	0.067	0.072	0.060	0.048	0.072
375	0.028	0.026	0.030	0.032	0.028	0.029	0.034	0.040	0.043	0.050	0.051	0.055	0.041	0.055
425	0.017	0.019	0.021	0.022	0.021	0.021	0.023	0.032	0.036	0.040	0.043	0.058	0.041	0.058
475	0.016	0.018	0.019	0.019	0.020	0.021	0.022	0.027	0.030	0.034	0.035	0.050	0.038	0.050
525	0.029	0.025	0.022	0.023	0.021	0.022	0.025	0.031	0.035	0.039	0.040	0.059	0.040	0.059
575	0.021	0.020	0.024	0.024	0.021	0.023	0.025	0.026	0.028	0.030	0.030	0.048	0.037	0.048
625	0.019	0.020	0.021	0.022	0.020	0.019	0.020	0.024	0.026	0.027	0.027	0.052	0.040	0.052
675	0.029	0.025	0.026	0.024	0.020	0.020	0.020	0.023	0.025	0.029	0.029	0.050	0.038	0.050
725	0.015	0.016	0.017	0.017	0.016	0.016	0.017	0.021	0.023	0.025	0.025	0.052	0.045	0.052
775	0.015	0.016	0.018	0.018	0.017	0.017	0.018	0.021	0.022	0.026	0.025	0.047	0.038	0.047
825	0.020	0.020	0.021	0.019	0.020	0.021	0.022	0.026	0.027	0.029	0.029	0.056	0.040	0.056
875	0.021	0.020	0.020	0.020	0.019	0.022	0.024	0.026	0.027	0.029	0.028	0.045	0.038	0.045
925	0.017	0.019	0.020	0.021	0.020	0.021	0.024	0.028	0.029	0.031	0.031	0.055	0.042	0.055
975	0.021	0.025	0.024	0.026	0.021	0.025	0.025	0.028	0.029	0.032	0.031	0.055	0.040	0.055
1025	0.016	0.018	0.018	0.021	0.019	0.018	0.020	0.024	0.026	0.030	0.029	0.056	0.050	0.056
1075	0.015	0.017	0.018	0.019	0.017	0.018	0.018	0.022	0.025	0.029	0.028	0.048	0.037	0.048
1125	0.017	0.020	0.020	0.023	0.020	0.021	0.022	0.024	0.026	0.030	0.029	0.106	0.041	0.106
1175	0.021	0.020	0.019	0.021	0.018	0.020	0.019	0.022	0.025	0.028	0.027	0.045	0.037	0.045
1225	0.016	0.018	0.018	0.019	0.018	0.019	0.022	0.025	0.028	0.030	0.030	0.069	0.038	0.069
1275	0.017	0.020	0.020	0.021	0.019	0.019	0.020	0.023	0.025	0.030	0.030	0.048	0.037	0.048
1325	0.015	0.017	0.017	0.019	0.017	0.016	0.018	0.021	0.024	0.028	0.030	0.055	0.044	0.055
1375	0.015	0.017	0.017	0.018	0.016	0.016	0.016	0.019	0.022	0.026	0.026	0.047	0.037	0.047
1425	0.016	0.020	0.018	0.021	0.018	0.019	0.019	0.022	0.026	0.029	0.028	0.055	0.039	0.055
1475	0.019	0.020	0.018	0.020	0.017	0.016	0.016	0.019	0.022	0.025	0.024	0.044	0.036	0.044
1525	0.017	0.018	0.018	0.021	0.018	0.017	0.018	0.022	0.025	0.027	0.026	0.054	0.035	0.054
1575	0.018	0.019	0.020	0.022	0.018	0.018	0.019	0.020	0.023	0.026	0.025	0.046	0.036	0.046
1625	0.016	0.018	0.017	0.019	0.016	0.015	0.016	0.018	0.020	0.024	0.023	0.055	0.036	0.055
1675	0.016	0.018	0.017	0.018	0.015	0.015	0.016	0.018	0.020	0.024	0.023	0.047	0.034	0.047
1725	0.017	0.020	0.019	0.020	0.018	0.016	0.017	0.020	0.022	0.025	0.024	0.049	0.034	0.049
1775	0.018	0.021	0.020	0.020	0.017	0.015	0.016	0.018	0.021	0.023	0.023	0.041	0.033	0.041
1825	0.017	0.018	0.021	0.020	0.018	0.016	0.017	0.020	0.022	0.025	0.024	0.046	0.031	0.046
1875	0.018	0.018	0.020	0.020	0.018	0.018	0.019	0.020	0.023	0.025	0.024	0.042	0.030	0.042
1925	0.016	0.016	0.019	0.019	0.015	0.015	0.015	0.017	0.019	0.022	0.021	0.049	0.030	0.049
1975	0.017	0.017	0.018	0.018	0.015	0.015	0.016	0.017	0.020	0.023	0.022	0.043	0.030	0.043

3、Higher frequency components:

Pbin(%)	0	10	20	30	40	50	60	70	80	90	100	104	110	Max
f(kHz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	(%)
2.1	0.071	0.051	0.056	0.083	0.110	0.103	0.143	0.174	0.205	0.239	0.248	0.230	0.195	0.248
2.3	0.057	0.047	0.051	0.057	0.062	0.059	0.081	0.103	0.120	0.147	0.149	0.125	0.156	0.156
2.5	0.054	0.055	0.052	0.067	0.062	0.082	0.117	0.129	0.137	0.154	0.155	0.134	0.063	0.155
2.7	0.071	0.059	0.048	0.053	0.053	0.070	0.096	0.121	0.145	0.190	0.178	0.128	0.139	0.190
2.9	0.049	0.040	0.042	0.036	0.033	0.032	0.039	0.056	0.080	0.119	0.114	0.172	0.109	0.172
3.1	0.047	0.044	0.042	0.035	0.031	0.028	0.032	0.045	0.061	0.077	0.091	0.151	0.071	0.151
3.3	0.032	0.029	0.025	0.023	0.020	0.016	0.018	0.025	0.035	0.040	0.051	0.110	0.036	0.110
3.5	0.014	0.014	0.013	0.011	0.010	0.008	0.009	0.011	0.014	0.016	0.019	0.286	0.014	0.286
3.7	0.011	0.012	0.011	0.010	0.009	0.007	0.006	0.007	0.009	0.010	0.012	0.065	0.008	0.065
3.9	0.007	0.008	0.009	0.008	0.007	0.005	0.005	0.005	0.006	0.006	0.008	0.074	0.007	0.074

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4.1	0.005	0.005	0.006	0.006	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.066	0.005	0.066
4.3	0.003	0.003	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.053	0.003	0.053
4.5	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.074	0.002	0.074
4.7	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.066	0.002	0.066
4.9	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.086	0.002	0.086
5.1	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.081	0.001	0.081
5.3	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.053	0.003	0.053
5.5	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.005	0.005	0.072	0.003	0.072
5.7	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.006	0.047	0.005	0.047
5.9	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.005	0.007	0.007	0.034	0.006	0.034
6.1	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.006	0.007	0.010	0.009	0.033	0.007	0.033
6.3	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.006	0.007	0.008	0.041	0.004	0.041
6.5	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.006	0.007	0.007	0.034	0.006	0.034
6.7	0.006	0.004	0.006	0.004	0.005	0.004	0.005	0.006	0.007	0.009	0.009	0.031	0.007	0.031
6.9	0.009	0.007	0.008	0.006	0.007	0.006	0.007	0.008	0.010	0.011	0.014	0.021	0.010	0.021
7.1	0.009	0.009	0.008	0.008	0.006	0.006	0.007	0.010	0.013	0.015	0.019	0.048	0.015	0.048
7.3	0.009	0.006	0.007	0.005	0.007	0.007	0.010	0.010	0.013	0.021	0.020	0.056	0.019	0.056
7.5	0.008	0.009	0.006	0.007	0.007	0.009	0.013	0.015	0.020	0.027	0.025	0.015	0.019	0.015
7.7	0.006	0.006	0.005	0.007	0.007	0.008	0.010	0.013	0.015	0.017	0.017	0.026	0.008	0.026
7.9	0.005	0.005	0.005	0.005	0.007	0.006	0.009	0.010	0.011	0.014	0.014	0.339	0.015	0.339
8.1	0.004	0.004	0.004	0.006	0.006	0.006	0.008	0.011	0.014	0.017	0.018	0.040	0.013	0.040
8.3	0.004	0.003	0.003	0.005	0.005	0.005	0.006	0.008	0.009	0.011	0.012	0.012	0.009	0.012
8.5	0.004	0.003	0.003	0.003	0.004	0.004	0.006	0.007	0.008	0.010	0.010	0.012	0.009	0.012
8.7	0.003	0.002	0.002	0.003	0.003	0.003	0.005	0.006	0.008	0.010	0.010	0.013	0.012	0.013
8.9	0.002	0.002	0.001	0.002	0.002	0.003	0.004	0.004	0.005	0.006	0.007	0.026	0.007	0.026